REPORT DOCUMENTATION PAGE Form Approved OMB No. 0704-0188 Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate only, other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (07804-0188), Washington, DC 20503. 3. REPORT TYPE AND DATES COVERED 2. REPORT DATE 1. AGENCY USE ONLY (LEAVE BLANK) 18 JUNE 1996 Professional Paper 5. FUNDING NUMBERS 4. TITLE AND SUBTITLE VH3D/60N Electromagnetic Pulse Hardness Assurance, Maintenance, and Surveillance Program 6. AUTHOR(S) Mark Mallory and Sam Frazier 8. PERFORMING ORGANIZATION 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) REPORT NUMBER Commander Naval Air Warfare Center Aircraft Division 22541 Millstone Road Patuxent River, Maryland 20670-5304 SPONSORING/MONITORING 9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) AGENCY REPORT NUMBER Naval Air Systems Command Department of the Navv 1421 Jefferson Davis Highway Arlington, VA 22243 11. SUPPLEMENTARY NOTES 12b. DISTRIBUTION CODE 12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited. 13. ABSTRACT (Maximum 200 words) HAMS Background **HAMS Definition** Purpose System Level Tests Baselines **HATs** Aircraft MODs Field Surveillance Test 19960916 021 HM/S Tester Inspections VH HAMS Database Program Milestones and Responsibilities 15. NUMBER OF PAGES SUBJECT TERMS 12 VH-3D/60N; Electromagnetic pulse hardness; VH-3D 16. PRICE CODE 20. LIMITATION OF ABSTRACT 19.SECURITY CLASSIFICATION OF 17. SECURITY CLASSIFICATION 18. SECURITY CLASSIFICATION OF REPORT OF THIS PAGE **UNCLASSIFIED** UNCLASSIFIED **UNCLASSIFIED**

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MAINTENANCE AND SURVEILLANCE ELECTROMAGNETIC PULSE HARDNESS ASSURANCE, PROGRAM N09/08 H/

Naval Air Warfare Center Aircraft Division Electromagnetic Transient Section E-Cubed Division

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MAINTENANCE AND SURVEILLANCE HARUNESS ASSURANCE,

DISCUSSION:

- HAMS Background
- HAMS Definition
- Purpose
- System Level Tests
- Baselines
- HATs
- Aircraft MODs
- Field Surveillance Test
 - HM/S Tester
- Inspections
- VH HAMS Database
- Program Milestones and Responsibilities



HIS-2 Aircraft

- Modified Version of the H-3
- Major Avionics Upgrade to Improve Communications, Navigation, and Flight Management Capabilities
 - Hardened to High Altitude Electromagnetic Pulse Environment
- HIS-2 EMP Test (Kirtland AFB 1985)
- Implemented Into All VH-3D Aircraft

N09-H7 •

- Basic UH-60A Black Hawk Airframe
- 1987 Boeing was Tasked to:
- Identify Mission Essential Equipment
- Assess Vulnerability of MEE
- Develop Hardening Approach
- Provide Detailed Hardening Requirements to Sikorsky



- Hardening Methods
- Windows
- Copper Screen Between Lamination
- Transparent Structure
- Aluminum Mesh in Fiberglass Lay-up
- Doors
- Conductive Gasket
- Control Rods, Cables
- In-Line Isolation Sections
- Grounding at Penetrations by Boots or Pulleys



- Hardening Methods (Cont.)
- Fuel, Hydraulic, Pneumatic Lines
- Peripheral Electrical Bond at Penetration
- External Wiring
- Braided Shielded Peripherally Terminated at Penetration and Outboard Equipment
- TPM for Some Wires (Feed Through Capacitors)
- Antennas
- Diodes/Spark Gaps to Protect Receivers
- TPMs for Non-RF Control Wires



- UPSET MARGIN DESIGN GOAL
- All Flight Critical Equipment
- All Mission Essential Equipment
- In All Aircraft Modes



MAINTENANGE AND SURVEILLANGE HARDNESS ASSURANCE,

(FIMMS)

Hardness Assurance

Procedures Applied During Production of a System to Ensure That the Production is in Compliance With the Hardness Design Specification or Requirements

Hardness Maintenance

Procedures Applied During the Service Life of a System to Ensure Maintenance do not Degrade the System's Designed Hardness Fhat the System's Operation, Logistic Support, and/or

Hardness Surveillance

 A Lifetime Cycle of Tests and Inspections Performed to Monitor System Hardness Integrity



FIAMS PURPOSE

- Maintained Throughout the Operational Life of The Aircraft To Ensure That Nuclear Hardness Design Integrity is
- To Monitor Aircraft Hardness Status and Report it to **Decision Makers**



HAMS PROGRAM

- Successful Completion of the VH-60N Baseline Test (1988) Led to NAVAIR Tasking NAWCAD PAX to Implement VH-3D/VH-60N HAMS Program (1990)
- Baseline Tests followed by a Series of System Level EMP Hardness Assessment Tests (HATs)
- Before & After Special Progressive Aircraft Rework (SPAR)
- Evaluate Major Aircraft Modifications
- Field Surveillance Tests
- VH HAMS Database



SYSTEM LEVEL EMP TESTS

- Special Progressive Aircraft Rework (SPAR) A Complete Inspection and Rework Performed at Regular Intervals on Each Aircraft
- Pre-SPAR HATS
- Provide Hardness Data on In-Service Aircraft
- How Well Hardness is Being Maintained at the Fleet
 - Post-SPAR HATS
- Provide Hardness Data on Aircraft Coming Out of SPAR
- Determine Whether the Hardening Devices Have Been Correctly Reinstalled
- Aircraft Modifications
- Verify Contractor Integration Did Not Effect the Overall Hardness of the Aircraft
 - Answer ECP Related Questions
- Maintaining the Overall EMP Hardness of the VH-3D & VH-60N Aircraft and Verify These HATs Ensure the Hardness Protection Procedures are Sufficient for the Safety Margin Design Goal



SYSTEM LEVEL EMP TESTS

FOUR PHASES

- Phase I Safety Demonstration/Active Systems Test (SD/AST)
- Phase II Passive System Test (PST)
- Phase III Low Level Continuous Wave (LLCW)
- Phase IV Current Injection Direct-Drive (CIDD)



SURVEILLANCE TESTING

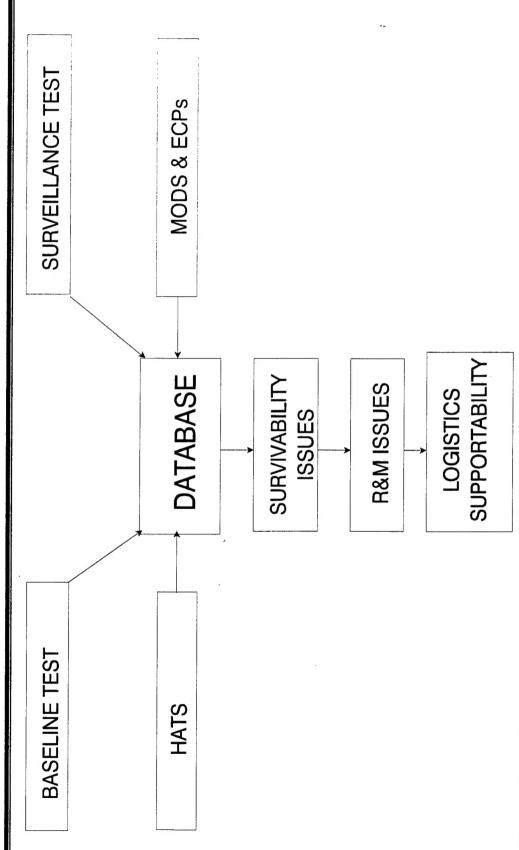
- Field Surveillance Tests Conducted at HMX-1 Quantico, VA with the Portable Hardness Maintenance/Surveillance (HM/S) Tester
- Purpose To Detect and Monitor Changes in Aircraft Hardness at the
- Conducted Once a Year on Each Aircraft on a Not-to-Interfere Basis
- Test Time- Approximately One Hour
 All Test Points are Easily Accessible
- The Tester Is A Monitoring Device Only It Cannot Establish Safety Margins Or Survivability/Vulnerability Characteristics
- Visual Inspections Conducted During Field Test



- The Tester Consists of a Synthesized Dual Frequency Transmitter, a Receiver, and Special Adapted Sensors
- Radiates a Continuous Damp Sine Wave at 1 Watt
- Entire Aircraft Illuminated Externally at 75.200 MHz
- E-Field & Current Measurements Made at Selected Test Points to Assess Overall Hardness of Aircraft
- Baseline Values are Recorded and Stored in Memory
- Is Also Used as a Sniffer to Evaluate Aircraft Apertures and EMP Points-of-Entry
- Does Not Replace System Level Test at NAWCAD



HAMS DATABASE



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TEST TEAM RESPONSIBILITIES

- Coordinate and Participate in HAMS Working Group Meetings
- Provide On-Site Engineer/Technical Support to the Fleet
 - Portable HM/S Tester
- EMP Technical Expertise
- Track Hardness Degradation of Each Aircraft
- Maintain the VH HAMS Database



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- System Level Tests One Aircraft Each Year
- Major Communication/Navigation System Upgrade (CNSU) Being Incorporated Into Both VH-3D & VH-60N Aircraft
- VH-60N CNSU EMP Baseline Test Scheduled For April 1996
- VH-3D CNSU EMP Baseline Test Scheduled For May 1996
- Field Testing Using the HM/S Tester
- Currently Evaluating Hardness Design for an EMP Sliding Glass Window to Replace the Fixed Window in the VH-3D Aircraft
- Conducted at the Squadron on A Not-To-Interfere Basis



SUMMARY

EMP SURVIVABILITY OF THE VH AIRCRAFT WILL BE ENSURED THROUGHOUT ITS LIFE-CYCLE BY:

- Maintaining Hardness Integrity Of Design
- Stringent Configuration Control
- Surveillance Testing
- Field Activities
- System Level At NAWCAD, Patuxent River